Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Revision of Part 15 of the Commission's Rules	)	ET Docket 98-153
Regarding Ultra-Wideband Transmission	)	
Systems	)	

EX PARTE COMMENTS OF DELPHI CORPORATION

Delphi Corporation ("Delphi"), by its undersigned attorneys, hereby submits these ex parte comments with respect to the Commission's "Further Notice of Proposed Rule Making" ("FNPRM") released on March 12, 2003, in the above-captioned proceeding.[1] These ex parte comments are filed in response to comments filed by (i) XtremeSpectrum Inc. ("XtremeSpectrum"), and (ii) the Satellite Industry Association ("SIA"), with regard to the UWB definition.

For the reasons set forth below and in Delphi's other comments in this proceeding,[2] the Commission should eliminate the minimum emissions bandwidth requirement of 500 MHz in order to qualify a device as a UWB device. If the Commission elects not to do so, the Commission should eliminate the minimum emissions bandwidth requirement of 500 MHz in order to qualify a device as a UWB device for devices operating between 22-29 GHz.[3] There are no parties operating in those frequencies opposing the elimination of the minimum bandwidth requirement.

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[1] "Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems", Memorandum Opinion and Order and Further Notice of Proposed Rulemaking, ET Docket No. 98-152, FCC 03-33, ¶¶153-166 (rel. March 12, 2003) ("MO&O and FNPRM").

[2] See Delphi's "Comments" filed on July 18, 2003, at p.8, and "Reply Comments" filed August 20, 2003, at p.3.

[3] The UWB regulations permit the operation of vehicular radar systems in the 22-29 GHz band. See 47 C.F.R. §15.515(b).

1. The Commission Should Eliminate the Minimum Bandwidth Requirement

The Commission has tentatively concluded that requiring a minimum emissions bandwidth of 500 MHz in order to qualify a device as a UWB device is an unnecessary regulatory constraint that could potentially hamper spectrum use, while not providing added interference protection to existing services.[4] The Commission is correct. Delphi's initial comments in this proceeding, as well as the initial comments filed by several other commenters, support the Commission's tentative conclusion. No commenters filed initial comments opposing the Commission's tentative conclusion. However, in reply comments, XtremeSpectrum opposes removal of the minimum bandwidth requirement, and SIA claims it should be removed on a case by case basis only.

XtremeSpectrum claims that Delphi has not indicated what applications would benefit from removal of the minimum bandwidth requirement. The fact of the matter is that many vehicular radar applications would benefit from removal of the requirement, including Pre-Crash Sensing Systems, Blind Spot Warning Systems, and Back-Up and Parking Aids. A brief description of each of these applications, as previously provided by the Short Range Automotive Radar Frequency Allocation Group ("SARA") to the Commission, is set forth below:

- The Pre-Crash Sensing System is a system that enhances road safety by continuously reading object position, velocity, and acceleration data from one or more radars, and tests that data for predetermined characteristics of an accident situation. When this situation arises, smart airbags can be configured or deployed, and advanced countermeasures such as seat belt tensioners can be engaged to mitigate the effects of the collision. In the distant future, brakes and steering will be activated to further reduce crash severity.

- The Blind Spot Warning System continuously observes the blind spots that typically evade a driver's view. When an object is in a blind spot, a clearly visible indicator lights up, allowing a quick glance by the driver to see if he/she has a clear adjacent lane to make a lane change. Without the Blind Spot Warning System, drivers must turn their heads and look over their shoulders to verify that the blind spot is clear as part of a lane

[4] MO&O and FNPRM at ¶166.

change maneuver. This causes the driver to look away from the front of the vehicle, which can lead to an accident. The Blind Spot Warning System simplifies and greatly enhances the safety of a lane change maneuver, especially in heavy rain where visibility through the rear view mirrors is poor.

- The Back-Up and Parking Aid gives the driver a warning when he or she is backing the car up towards an object (such as a child) in the vehicle's path. It is also assists drivers with parking, where the radar gives "room to maneuver" information to the driver that is much more accurate than the driver can discern alone.[5]

All of these applications will reduce the number of vehicular accidents, injuries and deaths, but the extent to which they benefit the public will be dependent in large part on their affordability and functionality. And that is where the minimum bandwidth requirement plays a role, but unfortunately it is a negative role. This requirement, if kept in place, will limit the functionality of these devices while increasing their costs. Simply put, elimination of the minimum bandwidth requirement would enable these devices to be developed with more functionality at less cost -- and with less interference potential as well. Of course, the greater the functionality of these applications and the more affordable they are, the more these safety-enhancing applications will be available to, and utilized by, the public.

Vehicular radars, such as those in the applications described above, inherently partition their field of view into sectors of constant range, each sector being defined as a range bin. The cost and functionality of the applications discussed above will depend to a large degree on the range bin depth of the devices.[6] The optimum range bin depth will vary between applications, and certain applications, such as Back-Up and Parking Aid, will have more than one optimum range bin depth, which depth can be changed when necessary (i.e. "on the fly").

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[5] See SARA's "Reply Comments on the FCC's Spectrum Policy Task Force Report" in ET Docket No. 02-135, p. 3-4 (February 27, 2003) (citing National Highway Traffic Safety Administration, "Traffic Safety Facts 2001," December 2002 (DOT HS 809,484), 2001 National Statistics and p. 85) ("SARA Task Force Report Reply Comments").

[6] For a further discussion regarding range bins and their use in vehicular radar devices, *See, e.g.*, "Ex Parte Comments of Delphi Automotive Systems Corporation" ("July 2001 Comments") and accompanying "Engineering Study" ("Study") filed July 13, 2001; "Comments" filed on September 12, 2000; and "Reply Comments" filed

As discussed below, it is extremely important that the appropriate range bin depth is used for each application. If the range bin depth is too small, the costs of the devices will be far greater than necessary because more bins will need to be used and, as discussed below, the functionality will suffer as well. If the range bin depth is too great, the sensor will be unable to discern spaces between objects and thus be incapable of determining the correct range data for the objects. Therefore, the range bin depth must be optimized for each device and, as discussed below, vehicular radar manufacturers must have flexibility with regard to the range bin depth.

In the automotive environment, lane widths are approximately 3.8 meters wide and cars are approximately 2 meters wide. As a result, applications such as the ones discussed previously, which involve the measurement of separation distances, following distances, near miss distances, and/or parking distances, would benefit greatly by the ability to accurately resolve target locations between 50 and 150 cm. Accordingly, the optimum range bin depth, while it will vary by application, will generally likely be somewhere between 50 and 150 cm for the applications described above.

For example, with respect to Pre-Crash Sensing devices, such devices need to distinguish between objects that are 2 or more meters apart from each other. Therefore, the optimum range bin depth is approximately 1 meter for such devices. Accordingly, where such devices need to cover a 12 meter area, only 12 range bins would be required if the optimum bin depth is utilized. If, however, the range bin depth is 60 centimeters ("cm") instead (and as described below such will be the range bin depth if the minimum bandwidth requirement is not removed), 20 range bins would be needed, thereby greatly increasing the cost of the product.

Not only would the cost increase, but the functionality would decrease. Specifically, the system response time (the time delay between first presence of an object in the zone of coverage

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October 12, 2000, Study at 11-12.

and the radar detecting the object), would be far worse if 20 range bins had to be used. Such is the case because more bins would need to be scanned each time (if there are 20 bins rather than 12), and each range bin must be scanned for at least a certain fixed amount of time, regardless of its depth. This in turn, would result in a decrease in the update rate, which is the rate by which new, independent information is provided to the driver, and which rate, of course, is of critical importance in automotive radar devices.

Yet, given that range bin depth is inversely proportional to bandwidth,[7] the current rules leave a gap of 60 cm to 120 cm in range bin depth for low power pulse and PN-BPSK UWB and ISM band sensors operating at 24.125 GHz center frequency. That is, unless the minimum bandwidth requirement is removed, the maximum range bin depth for a vehicular radar UWB device would be 60 cm; yet, for a vehicular radar non-UWB device the minimum range bin depth is 120 cm since the maximum bandwidth for such a device is 250 MHz. Accordingly, unless the minimum bandwidth requirement is eliminated, companies such as Delphi will be unable to have range bins between 60 cm and 120 cm.

This causes a major problem because, as discussed above, for Pre-Crash Sensing Systems, 1 meter is the optimum range bin depth. Moreover, Delphi has also recently determined that 1 meter range bins will be the optimum depth for Blind Spot Warning Systems as well. Furthermore, variable range bin sizes (i.e. 1 meter, ½ meter, ¼ meter and 1/8 meter) are the optimum bin sizes for Back-Up and Parking Aids, which, as discussed above, have range bin sizes that change when necessary. Thus, Blind Spot Warning Systems and Back- Up and Parking Aids would, in addition to Pre-Crash Sensing Systems, greatly benefit from elimination of the minimum bandwidth requirement.

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[7] *See* Study at 11-12.

Moreover, flexibility with regard to range bin depth is critical in these types of applications. One meter range bins are not the optimum depth for all vehicular radar UWB devices at all times and under all scenarios. Vehicular radar manufacturers will need to have range bin depths that are optimum for each product (and for some products "variable on the fly" as well) in order to maximize the functionality of the device, and minimize its costs. But this can only be done if the minimum bandwidth requirement is removed. If it is not removed, vehicular radar manufacturers will be artificially constrained from optimizing the range bin depth, to the detriment of the public.[8]

There is no question that system performance parameters include cost and update rate, and each of these are influenced by FCC emissions standards. These critical parameters are best optimized (e.g. benefits to the public maximized) by selecting the most appropriate range resolution (i.e. emissions bandwidth) for an application. Numerous applications demand *variable* range resolution to achieve acceptable cost / performance levels required to best benefit the public interest. The very fine resolution capability as offered by UWB devices as currently defined, where beneficial in some applications, actually increases the costs and reduces the performance in many other cases as shown above. Therefore, far fewer consumers may get the benefits of these products (and will get them only at increased cost and with less functionality) if the minimum bandwidth requirement is not removed.[9]

XtremeSpectrum argues that the Commission should not remove the minimum bandwidth requirement because adding noise to a signal violates Commission rules. For two reasons, this argument misses the point. First, as discussed above, by retaining the 500 MHz minimum

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[8] XtremeSpectrum also claims that Delphi has not indicated why such devices could not operate under non-UWB rules. As discussed above, the fact of the matter is systems can be designed to meet some of the applications, but only at a far greater cost and with less functionality.

[9] Size of the device is also an important factor in marketability of the product, and using a range bin depth that is smaller than optimal can, for some of the applications, actually increase the amount of circuitry necessary and

bandwidth requirement the public will be deprived of less expensive, more functional vehicular radar devices that will reduce the number of vehicular accidents, injuries and deaths. Accordingly, whether it is a violation of the Commission's rules to develop a device so that it meets the minimum bandwidth requirement is irrelevant to the issue at hand because keeping the minimum bandwidth requirement is contrary to the public interest as a general matter.

Second, there is nothing in the Commission's rules that would prohibit the designing of a device with a greater bandwidth to ensure compliance with UWB rules if the minimum bandwidth requirement is retained. Section 15.15(a) would not, as XtremeSpectrum suggests, in itself, bar designing a device so that it meets the Commission's current 500 MHz UWB minimum bandwidth requirements, even though a particular application could be met with less bandwidth at lower cost. Under the current rules, there is a significant, and contrary-to-the-public-interest, gap that exists with respect to the bandwidth that can be utilized for vehicular radar devices, as the ISM maximum bandwidth for devices operating at 24.125 GHz is 250 MHz and the UWB minimum bandwidth is 500 MHz. That 250 MHz gap corresponds to a gap in range bin depth coverage between 60 cm and 120 cm. In the numerous cases of applications that are best served by a 1 meter range bin depth, the sensor based on the current regulations must be designed to 60 cm capability, generating 200 MHz of excess bandwidth. Not only will this "over bandwidth design" use excess bandwidth, it will cost more and have slower response times than a design unconstrained by the minimum bandwidth rule.

In addition, XtremeSpectrum's argument that removing the requirement will be a concern for many other users of the restricted bands is not supported by commenters in this proceeding. Moreover, XtremeSpectrum's allegation that there is little to be gained from eliminating the minimum bandwidth requirement is wrong. As demonstrated above, removing that requirement

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therefore increase the size of the product, which will make the product less marketable.

is consistent with the public interest because it will result in making more products available at lower prices, and with greater functionality. As discussed previously, these devices will reduce the number of vehicular accidents, injuries and deaths. Thus, contrary to Xtreme Spectrum's allegation, there is much to be gained by eliminating the minimum bandwidth requirement.

SIA's proposal-- that the minimum bandwidth requirement should be eliminated only on a case by case basis -- should not be adopted. It would significantly deter manufacturers from designing and developing products that will benefit the public. Companies such as Delphi allocate substantial human and financial resources and spend millions of dollars in product design and development well before their devices are ready for submission to the Commission for approval. If SIA's approach were adopted by the Commission, the uncertainty created by such action would be far too great for Delphi and other similarly situated companies. Delphi, for example, would likely forego developing such devices -- even though they would be in the public interest if approved -- because Delphi cannot afford to risk wasting millions of dollars in development costs if the Commission, after considering the matter on a case by case basis, did not approve such devices because they failed to meet bandwidth requirements.

2. In the Alternative, the Commission should Eliminate the Minimum Bandwidth Requirement for Devices Operating Between 22-29 GHz

For all of the foregoing reasons, the Commission should eliminate the existing 500 MHz minimum bandwidth requirement. If the Commission elects not to do so, it should at least eliminate the minimum bandwidth requirement for devices operating between 22-29 GHz. Neither XtremeSpecrtrum nor SIA operate devices in those frequencies and no party operating in those frequencies opposes elimination of the minimum bandwidth requirement. Moreover, there is no question that as to those frequencies, XtremeSpectrum is wrong when it contends that eliminating the minimum bandwidth requirement will increase the use by UWB devices of

restricted bands. In fact, as discussed below, the opposite is true with respect to the 22-29 GHz band.

The Commission has required that the center frequency must be at least 24.075 GHz for UWB vehicular radar devices. Given that the relevant restricted band is between 23.6 GHz and 24 GHz, eliminating the minimum bandwidth requirements will actually reduce emissions in that band. For example, if the minimum bandwidth requirement is removed, a vehicular radar UWB device with a center frequency at 24.150 GHz would be permitted to have a bandwidth of 300 MHz, and therefore not have any emissions within the restricted bands. On the other hand, if the minimum bandwidth requirement stays in effect, a vehicular radar UWB device with a center frequency at 24.150 GHz will be required to have emissions within the restricted band since its bandwidth must be at least 500 MHz. Moreover, eliminating the minimum bandwidth requirement between 22 and 29 GHz will not only reduce the amount of emissions in the

restricted band, but it will also result in signals of lower total power, that have lower power spectral densities over broad ranges of the frequency spectrum, and therefore have a lower probability of causing interference.[10]

Respectfully submitted,

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Dated: September 29, 2003

[10] See Study at 11-12.